

Appendix B

EPA'S METEOROLOGICAL DATA ADJUSTMENT

METEOROLOGICAL DATA ADJUSTMENT BY EPA

EPA's adjustments to the meteorological dataset input into AERMOD are discussed in the Air Quality Modeling Technical Support Document: NJ 126 Petition of September 17, 2010 Section II.E (Meteorological Data), Section II.F (Summary of EPA's Analysis of the NJDEP Modeling) and Appendix B (EPA Assessment of Site Specific Meteorological Data). EPA made several significant changes to the meteorological data that have been historically used in the modeling of Portland with AERMOD (including NJDEP 126 Petition modeling). One was the addition of the sigma-w data (standard deviation of vertical wind velocity fluctuations) measured by SODAR. An additional concern is the recalculation of the land surface characteristics using a beta version AERSURFACE that has not been released to the public.

As a result of these changes and other changes by the EPA to the meteorology and surface parameters, AERMOD's prediction of Unit 1 and 2's maximum 99th percentile daily maximum 1-hour SO₂ concentration decreased by over 40 percent from that predicted in the NJDEP modeling (1402 ug/m³ vs. 835.8 ug/m³).

In addition, NJDEP believes that some of the other modifications made by EPA to the meteorological data used to determine the remedy level should not have been made. NJDEP is concerned that relatively new, untested techniques have been used to adjust the meteorological data instead of more well established procedures.

1 - Historical Precedence

The meteorological data used by NJDEP is consistent with that which has historically been used when modeling Portland's emissions with AERMOD. The meteorological data collected near Portland was first used in AERMOD in the 1999 Warren County Sulfur Dioxide Modeling Study (ENSR, 1999). Use of an AERMOD meteorological dataset similar to that used by NJDEP was approved by the Technical Assessment Group (TAG) that was assembled for this 1999 modeling effort. Members of the TAG included GPU (the former owner of Portland Power Plant), PPL, EPA Region 2, EPA Region 3, Pennsylvania DEP, and New Jersey DEP. All parties signed onto the February 26, 1999 "Agreement of Principal" regarding this modeling analysis.

It is also important to note that a meteorological dataset similar to that used by NJDEP without EPA's modifications was considered appropriate for use by the current and previous owners of Portland Power Plant. AERMOD modeling using this data has been submitted to PADEP, EPA Region 3, and NJDEP on numerous occasions by Portland's owners' consultants (ENSR, 1999; ENSR, 2000; AECOM, 2010). Previous owners of the Portland Power Plant have made detailed technical arguments on why the tower and SODAR meteorological data collected is representative of meteorological conditions in the Delaware River Valley where Portland is located without adjustment (Reliant, 2001).

The modeling results based on a meteorological dataset similar to that used by NJDEP without EPA's modifications were the basis for Reliant (owner of Portland Power Plant at that time)

September 11, 2001 application for a Minor Modification to Portland's Title V Air Operating Permit. The permit modification placed a 3-hour SO₂ emission limit of 8.73 tons on Units 1 and 13.35 tons on Unit 2. These values effectively lowered the 3-hour full load allowable SO₂ limit of these units by approximately 12 percent. A copy of the Reliant's September 11, 2001 permit application is Attachment I to this appendix.

40 CFR Part 51, Appendix W paragraph 8.3.1.2 recommends that when a emission limit for a source is based on a specific year of meteorological data, this same meteorological data be used in any future modeling of the source. Though from the same year, the changes made by EPA to the previously used meteorological data are significant enough to consider it a new set of data. The fact that the maximum 99th percentile daily maximum 1-hour SO₂ concentration predicted by AERMOD using the two meteorological datasets differ by 40 percent (1402 ug/m³ vs. 835.8 ug/m³) support this conclusion. The guidance in Appendix W implies that EPA should follow precedence and also model with a meteorological data similar to that used in previous evaluations.

2 - Use of SODAR Sigma-w Data

EPA modified the meteorological data it used to include the SODAR sigma-w data collected near the site. NJDEP raises three concerns about inclusion of the SODAR sigma-w data.

2.a – AERMOD Validation Studies

Review of the validation studies as referenced in the Technical Support Document indicates SODAR sigma-w data were never included as part of a AERMOD validation study, including those field studies conducted in complex terrain study (EPA, 2003; Perry, et al., 2005). The AERMOD validation study at Martins Creek only included turbulence measurements taken from meteorological towers, not from the SODAR. Consistent with these studies, the AERMOD meteorological data set used by NJDEP only included turbulence data from the meteorological towers.

AERMOD averages the vertical turbulence values such as sigma-w throughout the atmospheric layer through which the plume travels from the source to the receptor. Therefore, the SODAR sigma-w measurements at Portland taken above 100 meters will have a significant impact on the vertical dispersion of the plume. As mentioned on page 38 of the TSD, one would expect the model would perform better if measured sigma-w data at all levels were available. However, this theory has never been tested. In the AERMOD validation studies (EPA, 2003; Perry, et al., 2005) and in the modeling analysis conducted by NJDEP, the sigma-w values above the height of the meteorological tower were calculated internally by AERMOD. The accuracy of the model in predicting ground-level impacts using SODAR measured sigma-w above the height of the meteorological towers has never been demonstrated. Any inference that the model will make more accurate predictions of ground-level concentrations with the SODAR sigma-w data is speculation and not supported by the existing validation studies.

2.b - Effect of SODAR Sigma-w Data on Model Predictions

To assess the impact of EPA's inclusion of the SODAR sigma-w data, the meteorological dataset developed by the EPA for their 126 petition modeling was modified by NJDEP by removing all the SODAR sigma-w data. No other changes to the meteorological dataset used by EPA were made. The AERMOD was rerun with this modified meteorological dataset. Table 1 gives the model's predictions of the five highest 99th percentile of the daily maximum 1-hour concentrations for the two scenarios: meteorological data with the SODAR sigma-w data and meteorological data without the SODAR sigma-w data.

Table 1. AERMOD Top Five Predicted Impacts With and Without SODAR Sigma-W

East UTM (km)	North UTM (km)	Receptor Elv. (m)	Units 1 and 2 ^a (ug/m ³)
With SODAR Sigma-W			
494.400	4531.400	157	835.8
494.500	4531.600	168	826.9
494.400	4531.300	159	820.7
494.300	4531.200	156	813.8
494.400	4531.500	157	810.9
Without SODAR Sigma-W			
488.000	4533.400	401	938.5
488.100	4533.400	379	935.1
488.200	4533.500	402	922.4
489.300	4534.700	381	916.8
487.800	4533.600	397	913.5

a. Represents maximum 99th percentile of the daily maximum 1-hour concentrations

Modeling the emissions from Units 1 and 2 not using the SODAR sigma-w data increases the predicted maximum 99th percentile daily maximum 1-hour SO₂ concentration by 12 percent. The other receptors with the high predicted impacts show a similar increase. The location of the maximum impacts also changes to the elevated terrain on Kittatinny Ridge. These results bring into question whether AERMOD would have performed as well as it did in the previous validation studies (EPA, 2003; Perry, et al., 2005) if SODAR sigma-w data had been used.

3. Rerunning of AERSURFACE for Land Surface Characteristics

Page 62 of the TSD discusses NJDEP's modification of the surface roughness, Bowen ratio, and albedo used by NJDEP to characterize the land use around the Portland meteorological site. A beta version of AERSURFACE that has had very limited public review or availability was used by EPA to recalculate the surface roughness, Bowen ratio, and albedo.

3.a – Snow Cover

It appears EPA did not account for snow cover during the winter season in its beta AERSURFACE model run. The Allentown PA Airport is located approximately 25 miles southwest of the Portland meteorological tower. Review of the Climatological Data Monthly Summaries from the Allentown Airport indicates there was snow cover on the ground for approximately 67 percent of the time between December 1, 1993 to February 28, 1994. Similar to NJDEP, all previous uses of AERSURFACE to generate meteorological data for AERMOD assumed snow cover during the winter months (ENSR, 1999; ENSR, 2000).

3.b – Surface Roughness Radius of Influence

A value of 5 km was used for the surface roughness radius of influence used in EPA's beta AERSURFACE run. This value is extremely large for wind data with a 10 meter reference height.

3.c - Beta Version of AERSURFACE

Very little information concerning the beta version of the AERSURFACE used by EPA is available to the public so it is difficult to comment on its use. It is assumed this version of AERSCREEN uses the methodology briefly discussed in the AERSURFACE presentation at the 2010 Regional/State/Local workshop in Portland, Oregon (use of the internal boundary layer to calculate an effective surface roughness). Since this method is experimental, a sensitivity analysis was conducted by NJDEP to compare AERMOD's predictions using the surface roughness, Bowen ratio, and albedo generated using the beta version of AERSURFACE to AERMOD's predictions using the current version of AERSURFACE (version 08009) on the EPA SCRAM website and a 1 km surface roughness radius of influence. Snow cover in the winter months was also assumed.

Other than the recalculated surface roughness, Bowen ratio, and albedo values and the removal of the SODAR sigma-w data as described in comment 1.c, NJDEP made no other changes to the EPA meteorological data set. Table 2 shows the model's prediction of the five highest 99th percentile of the daily maximum 1-hour concentrations between the EPA 126 Petition modeling and the modeling with this revised meteorological dataset.

The results in Table 2 suggest that if EPA had used the current AERSURFACE (version 08009) on the EPA SCRAM website and included snow cover for the winter months, AERMOD's maximum predicted impacts would have been 16 percent higher. As with the results in Table 1, when the SODAR sigma-w was removed, the location of the maximum impacts using the AERSURFACE (version 08009) values is on the elevated terrain at Kittatinny Ridge.

Table 2. AERMOD Top Five Predicted Impacts With EPA's Meteorological Dataset and Without SODAR Sigma-W and Revised AERSURFACE Data

East UTM (km)	North UTM (km)	Receptor Elv. (m)	Units 1 and 2 ^a (ug/m ³)
With SODAR Sigma-W and beta AERSURFACE			
494.400	4531.400	157	835.8
494.500	4531.600	168	826.9
494.400	4531.300	159	820.7
494.300	4531.200	156	813.8
494.400	4531.500	157	810.9
Without SODAR Sigma-W and AERSURFACE version 08009			
488.100	4533.400	379	1,067.0
487.900	4533.700	389	1,057.8
488.000	4533.400	401	1,057.5
488.200	4533.500	402	1,009.0
487.800	4533.600	397	1,007.9

a. Represents maximum 99th percentile of the daily maximum 1-hour concentrations

4 - Conclusion

The AERMOD modeling submitted by NJDEP utilized the meteorological measurements collected near Portland as they have historically been used. The previous use of this meteorological data as approved by EPA Region 2, EPA Region 3, PADEP, NJDEP, and the owners of Portland Power Plant establishes a precedent that should be followed. There are also technical concerns with EPA's adjustments as explained in this Appendix. As compared to the result obtained by EPA using their adjusted meteorological data, the maximum 99th percentile daily maximum 1-hour SO₂ concentration increased by approximately 28 percent when NJDEP modeled Portland's emissions not using the SODAR sigma-w data, surface data from the beta version of AERSURFACE, and winter snow cover. The modifications made by EPA result in lower predicted SO₂ concentrations and increase the likelihood that actual SO₂ concentrations will be under-predicted. The consequence of this would be an inadequate remedy for Portland Power Plant and the exposure of nearby residents to SO₂ concentrations above the 1-hour NAAQS.

References

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Reliant, 2001. Letter from Vincent J. Brisini (Reliant) to Jane Mahinske (PADEP), Subject: *Responses to Items #1 and #2 of NJDEP Correspondence of March 27, 2001*, dated May 4, 2001.